Listing of Claims

1. (Previously presented) A commercial refrigeration system suitable for use in a supermarket, the commercial refrigeration system comprising:

a compressor, a condenser, a valve, a first evaporator coil, and a second evaporator coil, all of which are in fluid communication;

a first merchandiser adapted to be cooled by the first evaporator coil;

a second merchandiser adapted to be cooled by the second evaporator coil;

a system controller operable to control operation of the refrigeration system;

a subsystem controller in communication with the system controller, the subsystem controller being operable to monitor at least one parameter of a subsystem having at least one of, but not all of, the compressor, condenser, valve, and first merchandiser, and being further operable to communicate information relating to the monitored parameter to the system controller and to execute a command from the system controller to affect the operation of the subsystem; and

wherein at least one of the compressor and condenser is located remotely from the first merchandiser and the second merchandiser.

2. (Original) A commercial refrigeration system as set forth in claim 1 and further comprising a low voltage power and communication line extending from the system controller to the subsystem controller, the low voltage power and communication line enabling communication between the system controller and the subsystem controller and providing electrical power to the subsystem controller.

3. (Original) A commercial refrigeration system as set forth in claim 1 wherein the parameter is a safety parameter.

4. (Original) A commercial refrigeration system as set forth in claim 1 wherein the communication between the system controller and the subsystem controller is via wireless communication.

5. (Original) A commercial refrigeration system as set forth in claim 1 wherein the communication between the system controller and the subsystem controller is via wire communication.

6. (Previously presented) The commercial refrigeration system of claim 1 wherein the system controller further comprises a communication channel extending from the system controller to the subsystem controller, wherein the system controller and the subsystem controller communicate digitally over the communication channel.

7. (Original) A commercial refrigeration system as set forth in claim 1 wherein the subsystem controller communicates the at least one parameter to the system controller.

8. (Previously presented) A commercial refrigeration system as set forth in claim 1 wherein the refrigeration system further comprises a refrigeration branch having at least one of the valve and first evaporator coil, wherein the subsystem includes the refrigeration branch, and wherein the subsystem controller is operable to monitor at least one parameter of the refrigeration branch and to execute a command from the system controller to affect the operation of the refrigeration branch.

9. (Original) A commercial refrigeration system as set forth in claim 8 and further comprising a low voltage power and communication line extending from the system controller to the subsystem controller, the low voltage power and communication line enabling communication between the system controller and the subsystem controller and providing electrical power to the subsystem controller.

10. (Original) A commercial refrigeration system as set forth in claim 8 wherein the subsystem controller is a branch control module associated with the refrigeration branch.

11. (Original) A commercial refrigeration system as set forth in claim 8 and further comprising a suction stop switch responsive to a suction control signal from the subsystem

controller to selectively prevent the compressor from drawing refrigerant away from the evaporator such that refrigerant ceases to flow through the evaporator.

12. (Original) A commercial refrigeration system as set forth in claim 8 and further comprising a liquid line control switch responsive to a refrigeration control signal from the subsystem controller to prevent the refrigerant from flowing into the evaporator whereby the subsystem controller selectively cycles the liquid line control switch to affect a temperature of the fixture.

13. (Original) A commercial refrigeration system as set forth in claim 8 and further comprising a defrost control switch responsive to a defrost control signal from the subsystem controller to enable a defrosting gas to flow through the evaporator for defrosting the evaporator.

14. (Previously presented) A commercial refrigeration system as set forth in claim 8 where the valve comprises a pressure regulator valve responsive to a valve position signal from the branch controller to control a pressure of the refrigerant flowing through the first evaporator coil.

15. (Previously presented) A commercial refrigeration system as set forth in claim 8 wherein the system controller selectively supplies a branch set point signal having a parameter representative of a desired characteristic of the refrigeration branch, and wherein the subsystem controller receives the branch set point signal and determines a branch control action in response thereto.

16. (Previously presented) A commercial refrigeration system as set forth in claim 1 wherein the subsystem includes the first merchandiser, and wherein the subsystem controller is operable to monitor at least one parameter of the first merchandiser and to execute a command from the system controller to affect the operation of the first merchandiser.

17. (Currently amended) A commercial refrigeration system as set forth in claim 16 wherein the system controller selectively supplies a fixture set point signal to the subsystem controller over the communication channel, the fixture set point signal having a parameter indicative of a

desired operating set point for ~~the at least one fixture~~ the first merchandiser, and the subsystem controller being responsive to the fixture set point signal for determining a fixture control action.

18. (Original) A commercial refrigeration system as set forth in claim 17 wherein the refrigeration system further comprises a pressure regulator valve having a plurality of valve positions, wherein the subsystem controller selectively supplies a pressure valve control signal to the pressure regulator valve, the pressure valve control signal having a parameter representative of a desired valve position for the pressure regulator valve, and wherein the determined fixture control action comprises determining the desired valve position as a function of the fixture set point signal.

19. (Currently amended) A commercial refrigeration system as set forth in claim 17 wherein the refrigeration system further comprises a switching module, wherein the subsystem controller selectively provides a switch control signal to the switching module for operating a switch controlled function associated with the ~~at least one fixture~~ first merchandiser, and wherein the determined fixture control action comprises determining the switch controlled function as a function of the fixture set point signal.

20. (Currently amended) The commercial refrigeration system of claim 17 wherein the switch control function comprises at least one of controlling an anti-sweat heater associated with the ~~at least one fixture~~ first merchandiser, controlling a defrost cycle associated with the ~~at least one fixture~~ first merchandiser, and controlling a light associated with the ~~at least one fixture~~ first merchandiser.

21. (Currently amended) A commercial refrigeration system as set forth in claim 16 wherein the refrigeration system further comprises a merchandiser sensor associated with the first merchandiser, the merchandiser sensor providing a signal having the at least one parameter, and wherein the subsystem controller receives the signal from the sensor and supplies the at least one parameter to the system controller.

22. (Currently amended) A commercial refrigeration system as set forth in claim 21 wherein the subsystem controller includes a fixture control unit, the fixture control unit communicating with the system controller, a fixture display unit receiving the sensed signal and supplying the at least one parameter to the fixture control unit for transmission to the system controller, the fixture display unit providing a fixture control signal for controlling a control function associated with the ~~fixture~~ first merchandiser, a switching unit associated with the fixture display unit, and the switching unit receiving the fixture control signal from the fixture display unit and initiating the fixture control function in response thereto.

23. (Currently amended) A commercial refrigeration system as set forth in claim 22 wherein the system further comprises a fixture data bus extending between the subsystem controller and the ~~at least one fixture~~ merchandiser sensor, and wherein the ~~at least one fixture~~ merchandiser sensor comprises a plurality of sensors, each of said plurality of sensors providing digital data to the subsystem controller over the fixture data bus.

24. (Currently amended) A commercial refrigeration system as set forth in claim 23 wherein at least one of the plurality of sensors comprises a temperature sensor constructed and arranged to provide a digital representation of a temperature condition associated with the ~~fixture~~ first merchandiser.

25. (Currently amended) A commercial refrigeration system as set forth in claim 24 wherein the fixture data bus comprises a single twisted pair data bus such that only one data bus is required to facilitate communication between the ~~fixture~~ subsystem controller and the plurality of temperature sensors.

26. (Previously presented) A commercial refrigeration system as set forth in claim 16 wherein the subsystem controller executes a command from the system controller to perform one of an anti-sweat function associated with the first merchandiser, a defrost cycle associated with the first merchandiser, and a light control associated with the first merchandiser.

27. (Previously presented) A commercial refrigeration system as set forth in claim 21 and further comprising a refrigerant supply line supplying a pressurized refrigerant to the first evaporator coil.

28. (Original) A commercial refrigeration system as set forth in claim 27 wherein the subsystem controller selectively supplies a pressure control signal having a parameter indicative of a desired pressure setting for the pressurized refrigerant, and wherein the commercial refrigeration system further comprises an evaporator pressure regulator valve responsive to the pressure control signal for controlling a pressure of the pressurized refrigerant.

29. (Currently amended) A commercial refrigeration system as set forth in claim 28 wherein the ~~fixture~~ subsystem controller determines the desired pressure setting as a function of the at least one parameter.

30. (Original) A commercial refrigeration system as set forth in claim 28 wherein the system controller determines the desired pressure setting as a function of the at least one parameter.

31. (Original) A commercial refrigeration system as set forth in claim 21 wherein the at least one parameter comprises a system pressure.

32. (Original) A commercial refrigeration system as set forth in claim 21 wherein the at least one parameter comprises a system temperature.

33. (Original) A commercial refrigeration system as set forth in claim 1 wherein the subsystem includes the compressor, and wherein the subsystem controller is operable to monitor at least one parameter of the compressor and to execute a command from the system controller to affect the operation of the compressor.

34. (Original) A commercial refrigeration system as set forth in claim 33 wherein the subsystem controller is a compressor control module associated with the compressor.

35. (Original) A commercial refrigeration system as set forth in claim 33 and further comprising a low voltage power and communication line extending from the system controller to the subsystem controller, the low voltage power and communication line enabling communication between the system controller and the subsystem controller and providing electrical power to the subsystem controller.

36. (Original) A commercial refrigeration system as set forth in claim 33 wherein the subsystem controller includes a processor and a sensor in communication with the processor to monitor the at least one parameter of the compressor.

37. (Original) A commercial refrigeration system as set forth in claim 33 wherein the subsystem controller further compressor a switch in communication with the processor, the switch being operable to turn the compressor off and on in response to commands from the processor.

38. (Original) A commercial refrigeration system as set forth in claim 33 wherein the subsystem controller is operable in a standard operating mode and in a system controller failure mode, and wherein in the standard operation mode, the compressor is operated by the subsystem controller in response to commands from the system controller.

39. (Original) The commercial refrigeration system as set forth in claim 33 wherein the refrigeration system further comprises a second compressor in fluid communication with the condenser, valve, and evaporator coil, and a second subsystem controller being operable to monitor at least one parameter of the second compressor and to execute a command from the system controller to affect the operation of the second compressor.

40. (Original) A commercial refrigeration system as set forth in claim 39 and further comprising a low voltage power and communication line extending from the system controller to the first and second subsystem controllers, the low voltage power and communication line enabling communication between the system controller and the first and second subsystem controllers and providing electrical power to the first and second subsystem controllers.

41. (Original) A commercial refrigeration system as set forth in claim 40 wherein the first and second subsystem controllers are constructed and arranged for communicating with the other subsystem controller over the low voltage power and communication line.

42. (Original) A commercial refrigeration system as set forth in claim 39 wherein each subsystem controller includes a unique address having a hierarchy with respect to other subsystem controller.

43. (Original) A commercial refrigeration system as set forth in claim 42 wherein, in an absence of a command signal by the system controller, one of the subsystem controllers, based upon the hierarchy of addresses, assumes control of the refrigeration system.

44. (Original) A commercial refrigeration system as set forth in claim 1 wherein the subsystem controller is operable to monitor at least one parameter of the condenser and to execute a command from the system controller to affect the operation of the condenser.

45. (Original) A commercial refrigeration system as set forth in claim 44 wherein the subsystem controller is a condenser control module associated with the condenser.

46. (Original) A commercial refrigeration system as set forth in claim 44 wherein the condenser includes a fan, and wherein the subsystem controller includes a fan control module associated with the fan.

47. (Previously presented) A commercial refrigeration system as set forth in claim 1 wherein the subsystem includes the valve, and wherein the subsystem controller is operable to monitor at least one parameter of the valve and to execute a command from the system controller to affect the operation of the valve.

48. (Original) A commercial refrigeration system as set forth in claim 47 and further comprising a low voltage power and communication line extending from the system controller to

the subsystem controller, the low voltage power and communication line enabling communication between the system controller and the subsystem controller and providing electrical power to the subsystem controller.

49. (Previously presented) A commercial refrigeration system as set forth in claim 47 wherein the first evaporator coil has a temperature, and wherein the refrigeration system further comprises a refrigeration line in fluid communication with the first evaporator coil, the refrigeration line supplying a refrigerant to the first evaporator coil, and wherein the valve comprises a pressure regulator valve having a plurality of valve positions, the pressure regulator valve controlling the supply of the refrigerant to the first evaporator coil through the refrigeration line such that the temperature of the first evaporator coil is a function of the plurality of valve positions.

50. (Original) A commercial refrigeration system as set forth in claim 49 wherein the system controller selectively supplies a set point signal having a parameter representative of a desired operating condition of the refrigeration system, wherein the subsystem controller receives the set point signal over the communication channel and determines a valve drive signal as a function of the set point signal, and wherein the subsystem controller supplies the determined valve drive signal to the electronically controlled valve such that the desired refrigeration system operating condition is substantially achieved.

51. (Original) A commercial refrigeration system as set forth in claim 47 wherein the subsystem controller is a valve control module associated with the valve.

52. (Original) A commercial refrigeration system as set forth in claim 1 wherein the subsystem controller includes a processor and a sensor in communication with the processor to monitor the at least one parameter of the subsystem.

53. (Previously presented) A commercial refrigeration system as set forth in claim 1 wherein the refrigeration system further comprises a second subsystem controller being operable to monitor at least one parameter of a second subsystem having at least one of, but not all of, the

compressor, condenser, valve, and the second merchandiser, and being further operable to communicate information relating to the monitored parameter to the system controller and to execute a command from the system controller to affect the operation of the second subsystem.

54. (Original) A commercial refrigeration system as set forth in claim 53 and further comprising a low voltage power and communication line extending from the system controller to the first and second subsystem controllers, the low voltage power and communication line enabling communication between the system controller and the first and second subsystem controllers and providing electrical power to the first and second subsystem controllers.

55. (Previously presented) A commercial refrigeration system as set forth in claim 53 wherein the refrigeration system further comprises a refrigeration branch having at least one of the valve and first evaporator coil, wherein the first subsystem includes the refrigeration branch, wherein the first subsystem controller is operable to monitor at least one parameter of the refrigeration branch and to execute a command from the system controller to affect the operation of the refrigeration branch, wherein the second subsystem includes the compressor, and wherein the second subsystem controller is operable to monitor at least one parameter of the compressor and to execute a command from the system controller to affect the operation of the compressor.

56. (Previously presented) A commercial refrigeration system as set forth in claim 53 wherein the refrigeration system further comprises a refrigeration branch having at least one of the valve and first evaporator coil, wherein the first subsystem includes the refrigeration branch, wherein the first subsystem controller is operable to monitor at least one parameter of the refrigeration branch and to execute a command from the system controller to affect the operation of the refrigeration branch, wherein the second subsystem includes the condenser, and wherein the second subsystem controller is operable to monitor at least one parameter of the condenser and to execute a command from the system controller to affect the operation of the condenser.

57. (Original) A commercial refrigeration system as set forth in claim 53 wherein the first subsystem includes the compressor, wherein the first subsystem controller is operable to monitor at least one parameter of the compressor and to execute a command from the system controller to

affect the operation of the compressor, wherein the second subsystem includes the condenser, and wherein the second subsystem controller is operable to monitor at least one parameter of the condenser and to execute a command from the system controller to affect the operation of the condenser.

58. (Original) A commercial refrigeration system as set forth in claim 53 wherein the first subsystem includes the compressor, wherein the first subsystem controller is operable to monitor at least one parameter of the compressor and to execute a command from the system controller to affect the operation of the compressor, wherein the second subsystem includes the valve, and wherein the second subsystem controller is operable to monitor at least one parameter of the valve and to execute a command from the system controller to affect the operation of the valve.

59. (Previously presented) A commercial refrigeration system as set forth in claim 1 wherein the first evaporator coil performs a cooling function, wherein the compressor is in fluid communication with the first evaporator coil for drawing refrigerant away from the first evaporator coil, wherein the condenser is in fluid communication with the compressor for receiving refrigerant from the compressor, wherein the condenser removes heat from the refrigerant, wherein the valve is in fluid communication with the condenser for receiving refrigerant from the condenser, and wherein the valve being delivers refrigerant into the first evaporator coil.

60. (Original) A commercial refrigeration system as set forth in claim 1 wherein the subsystem includes the compressor, wherein the subsystem controller is a compressor operating unit associated with the compressor, the operating unit monitoring at least one operating parameter of the compressor and determining whether the operating parameter is within specification.

61. (Original) A commercial refrigeration system as set forth in claim 60 and further comprising a power and communication line extending from the system controller to the compressor operating unit and providing electrical power for the compressor operating unit.

62. (Original) A commercial refrigeration system as set forth in claim 1 wherein the subsystem includes the condenser, wherein the refrigeration system further comprises a condenser fan associated with the condenser, wherein the subsystem controller includes a condenser controller in communication with the system controller, and wherein the condenser controller is operable to monitor at least one parameter of the condenser and to provide a fan control signal.

63. (Original) A commercial refrigeration system as set forth in claim 62 wherein the refrigeration system further comprises a fan control unit associated with the condenser fan for controlling an operation of the condenser fan in response to the fan control signal.

64. (Original) A commercial refrigeration system as set forth in claim 63 and further comprising a power and communication line extending from the condenser controller to the fan control unit and providing electrical power for the fan control unit.

65. (Original) A commercial refrigeration system as set forth in claim 1 wherein the subsystem includes the valve, wherein the valve includes an electronically controlled valve, and wherein the subsystem controller is a valve controller, the valve controller providing a valve control signal to the electronically controlled valve to position the electronically controlled valve at a desired setting in response to a valve control signal from the system controller.

66. (Original) A commercial refrigeration system as set forth in claim 1 wherein the refrigeration system further comprises at least one branch control switch, wherein the subsystem includes the at least one branch control switch, and wherein the subsystem controller is a branch controller providing at least one branch control signal to the at least one branch control switch in response to a branch control command from the system controller.

67. (Original) A commercial refrigeration system as set forth in claim 1 wherein the evaporator performs a cooling function, the compressor is in fluid communication with the evaporator for drawing refrigerant away from the evaporator, the condenser is in fluid communication with the compressor for receiving refrigerant from the compressor, the condenser

removing heat from the refrigerant, the valve is in fluid communication with the condenser for receiving refrigerant from the condenser, the valve delivering refrigerant into the evaporator,

wherein the subsystem includes a compressor,

wherein the subsystem controller is a compressor operating unit associated with the compressor, the operating unit monitoring at least one operating parameter of the compressor and determining whether the operating parameter is within specification,

wherein the refrigeration system further comprises:

a first power and communication line extending from the system controller to the compressor operating unit and providing electrical power for the compressor operating unit;

a condenser fan associated with the condenser;

a condenser controller in communication with the system controller, the condenser controller being operable to monitor at least one parameter of the condenser and to provide a fan control signal;

a fan control unit associated with the condenser fan for controlling an operation of the condenser fan in response to the fan control signal; and

a second power and communication line extending from the condenser controller to the fan control unit and providing electrical power for the fan control unit.

68. (Original) A commercial refrigeration system as set forth in claim 67 and further comprising:

an electronically controlled valve;

a valve controller in communication with the system controller, the valve controller providing a valve control signal to the electronically controlled valve to position said electronically controlled valve at a desired setting in response to a valve control signal from the system controller;

at least one branch control switch controlling a flow of refrigerant; and

a branch controller in digital communication with the system controller, the branch controller providing at least one branch control signal to the at least one branch control switch in response to a branch control command from the system controller.

69. (Currently amended) A commercial refrigeration system as set forth in claim 68 and further comprising:

at least one fixture sensor associated with the ~~fixture~~ first merchandiser, the at least one fixture sensor providing a signal having a sensed parameter representative of an operating condition associated with the ~~fixture~~ first merchandiser;

a fixture controller in communication with the system controller, the fixture controller receiving the sensor signal from the at least one fixture sensor and supplying the sensed parameter to the system controller.

70. (Currently amended) A commercial refrigeration system as set forth in claim 68 wherein the fixture controller includes a fixture control unit, the fixture control unit communicating with the system controller, a fixture display unit receiving the sensor signal and supplying the sensed parameter to the fixture control unit for transmission to the system controller, the fixture display unit providing a fixture control signal for controlling a control function associated with the ~~fixture~~ first merchandiser, a switching unit associated with the fixture display unit, and the switching unit receiving the fixture control signal from the fixture display unit and initiating the fixture control function in response thereto.

71. (Currently amended) A commercial refrigeration system as set forth in claim 70 wherein the fixture control signal comprises at least one of an anti-sweat control signal controlling an anti-sweat function associated with the fixture, a defrost signal controlling a defrost cycle associated with the ~~fixture~~ first merchandiser, and a light control signal controlling a light associated with the fixture.

72. (Original) A commercial refrigeration system as set forth in claim 1 and further comprising an input/output device in communication with the system controller, the input/output device providing access to a system condition parameter associated with the commercial refrigeration system.

73. (Original) A commercial refrigeration system as set forth in claim 72 and further comprising a communication channel providing communication between the system controller and the input/output device.

74. (Original) A commercial refrigeration system as set forth in claim 73 wherein the communication channel comprises a wireless communication channel.

75. (Previously presented) A commercial refrigeration system as set forth in claim 1 and further comprising a secondary cooling loop constructed and arranged for cooling the first fixture, the evaporator being in heat exchange relationship with the secondary cooling loop for removing heat therefrom.

76. (Original) A commercial refrigeration system as set forth in claim 33 wherein the subsystem includes the compressor, wherein the compressor includes a compressor motor and a switch device comprising a three-phase solid state relay for selectively supplying three-phase power to the compressor motor, the three-phase solid state relay including a phase detector providing a plurality of phase reference signals indicative of a phase relationship of the three-phase power, wherein the subsystem controller monitors the plurality of phase reference signals to determine if it is safe to apply the three-phase power to the motor associated with the compressor.

77. (Original) The refrigeration system of claim 76 wherein the subsystem controller includes a current detection circuit associated with the switch device, said current detection circuit being adapted to detect an overcurrent condition associated with the switch device and crowbar the switch device to a non-conducting state when the overcurrent condition is detected.

78. (Previously presented) A method of installing an aspect of a commercial refrigeration system comprising

a compressor, a condenser, a valve, and an evaporator coil, all of which are in fluid communication,

a first fixture adapted to be cooled by the first evaporator coil,

a system controller operable to control operation of the refrigeration system including providing a command, and

a subsystem controller in communication with the system controller, the subsystem controller being operable to control operation of a subsystem of the refrigeration system in response to the command, the subsystem including at least one of, the compressor, condenser, valve, and fixture, the method comprising:

installing the system controller at a first location;

installing the subsystem controller at a second location;

connecting a source of electrical power to the system controller;

installing a power and communication line between the system controller and the subsystem controller;

during operation of the refrigeration system,

communicating the command from the system controller to the subsystem controller over the power and communication line;

transmitting power from the system controller to the subsystem over the power and communication line concurrently with communicating the command; and

transmitting power from the system controller to the subsystem over the power and communication line nonconcurrently with communicating the command.

79. (Original) A method as set forth in claim 78 wherein no separate power line for the subsystem controller must be wired upon installation of the commercial refrigeration system.

80. (Original) A method as set forth in claim 78 wherein the subsystem comprises a compressor subsystem and the subsystem controller comprises a compressor operating unit constructed and arranged for monitoring at least one operating parameter of the compressor and determining whether the operating parameter is within a specification limit.

81. (Original) A method as set forth in claim 78 wherein the subsystem comprises a branch control subsystem controlling a refrigeration branch having the evaporator, and wherein the subsystem controller comprises a branch controller constructed and arranged for controlling the

flow of a refrigerant flowing in a refrigeration line associated with the refrigeration branch in response to the command.

82. (Original) A method as set forth in claim 78 wherein the subsystem comprises the valve having a valve position and the subsystem controller comprises a valve controller selectively controlling the position of the control valve in response to the command.

83. (Original) A method as set forth in claim 78 wherein the first location and second location are on a common rack.

84. (Original) A method as set forth in claim 83 wherein the subsystem comprises a condenser subsystem including a fan and the subsystem controller comprises a condenser controller selectively controlling an operation of the fan in response to the command.

85. (Original) A method as set forth in claim 83 wherein the subsystem comprises a display fixture subsystem including the fixture being cooled by the evaporator, and wherein the subsystem controller comprises a fixture controller selectively controlling the flow of refrigerant through the evaporator.

86. (Cancelled).

87. (Previously presented) A method as set forth in claim 78 wherein the evaporator coil is a first evaporator coil, the commercial refrigeration system further comprises a second evaporator coil in fluid communication with the compressor, condenser, valve, and first evaporator coil, wherein the fixture is a first fixture adapted to be cooled by the first evaporator coil, wherein the commercial refrigeration system further comprises a second fixture adapted be cooled by the second evaporator coil, wherein the subsystem does not include all of the compressor, condenser, valve and first fixture, and wherein the subsystem controller is further operable to communicate information relating to the monitored parameter to the system controller.